JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Introduction of High Efficiency Electrolyzer in Chlor-Alkali Production Plant

A.2. General description of project and applied technologies and/or measures

JANA produces chlorine and caustic soda, in which process large amount of electrical power is consumed. This project is intended to replace the existing elements of ion exchange membrane (IEM) brine electrolyzers to the latest model which will contribute to reducing energy consumption. The bipolar electrolyzer consists of multiple elements, which have cathode and anode chambers, and IEMs are installed between each element. The latest high efficiency model is developed for optimum performance design by optimizing elements' inner structures and electrode shape, reducing resistance (lowering the voltage) of various components and preventing the mechanical damage for IEM thus achieving lower power consumption and contributing to energy saving.

A.3. Location of project, including coordinates

Country	Saudi Arabia
Region/State/Province etc.:	Eastern Province
City/Town/Community etc:	Jubail Industrial City-31961
Latitude, longitude	N 27° 00' 47.03" E 49° 32' 33.87"

A.4. Name of project participants

The Kingdom of Saudi Arabia	Jubail Chemical Industries Company (JANA)
Japan	Kanematsu Corporation

A.5. Duration

Starting date of project operation	25/01/2017
Expected operational lifetime of project	5 years

A.6. Contribution from developed countries

The proposed project was partially supported by the Ministry of the Environment, Japan (MOEJ) through the Financing Programme for JCM Model projects, which provided financial

support of less than half of the initial investment for the projects in order to acquire JCM credits. Further, implementation of the proposed project promotes technology transfer of low carbon technologies of Saudi Arabia.
In addition, OJT including operation and monitoring has been provided by Thyssenkrupp Uhde Chlorine Engineers (Japan) Ltd.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	SA_AM001
Version number	ver01.0

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

<table>
<tr><th>Eligibility criteria</th><th>Descriptions specified in the methodology</th><th>Project information</th></tr>
<tr><td>Criterion 1</td><td>Project electrolyzer employs an ion-exchange membrane technology in electrolyzers in the manufacturing process of chlor-alkali and the electrolyzer is the bipolar type.</td><td>The project installs the bipolar type ion exchange membrane (IEM) brine electrolyzers system in chlorine and caustic soda production process in Jubail Industrial City.</td></tr>
<tr><td>Criterion 2</td><td>Specific electricity consumption (SEC) for project electrolyzer i under the standard conditions, 32% NaOH and 90 degrees Celsius is less than threshold SEC values set in the table below under the standard conditions, 32% NaOH and 90 degrees Celsius;
<table>
<tr><th>CD (Current density) [kA/m^2]</th><th>Threshold SEC value of the electrolyzer [kWh(DC)/t-NaOH]</th></tr>
<tr><td>$4.0 \leq CD < 4.5$</td><td>2,045</td></tr>
<tr><td>$4.5 \leq CD < 5.0$</td><td>2,088</td></tr>
<tr><td>$5.0 \leq CD < 5.5$</td><td>2,131</td></tr>
<tr><td>$5.5 \leq CD < 6.0$</td><td>2,174</td></tr>
<tr><td>$6.0 \leq CD < 6.5$</td><td>2,217</td></tr>
</table></td><td>The project SEC derived from the specification of the project electrolyzer is 1990 kWh(DC)/t-NaOH when CD is between 4.5 and 5.0, and is less than the threshold SEC value (2,088 kWh(DC)/t-NaOH).</td></tr>
</table>

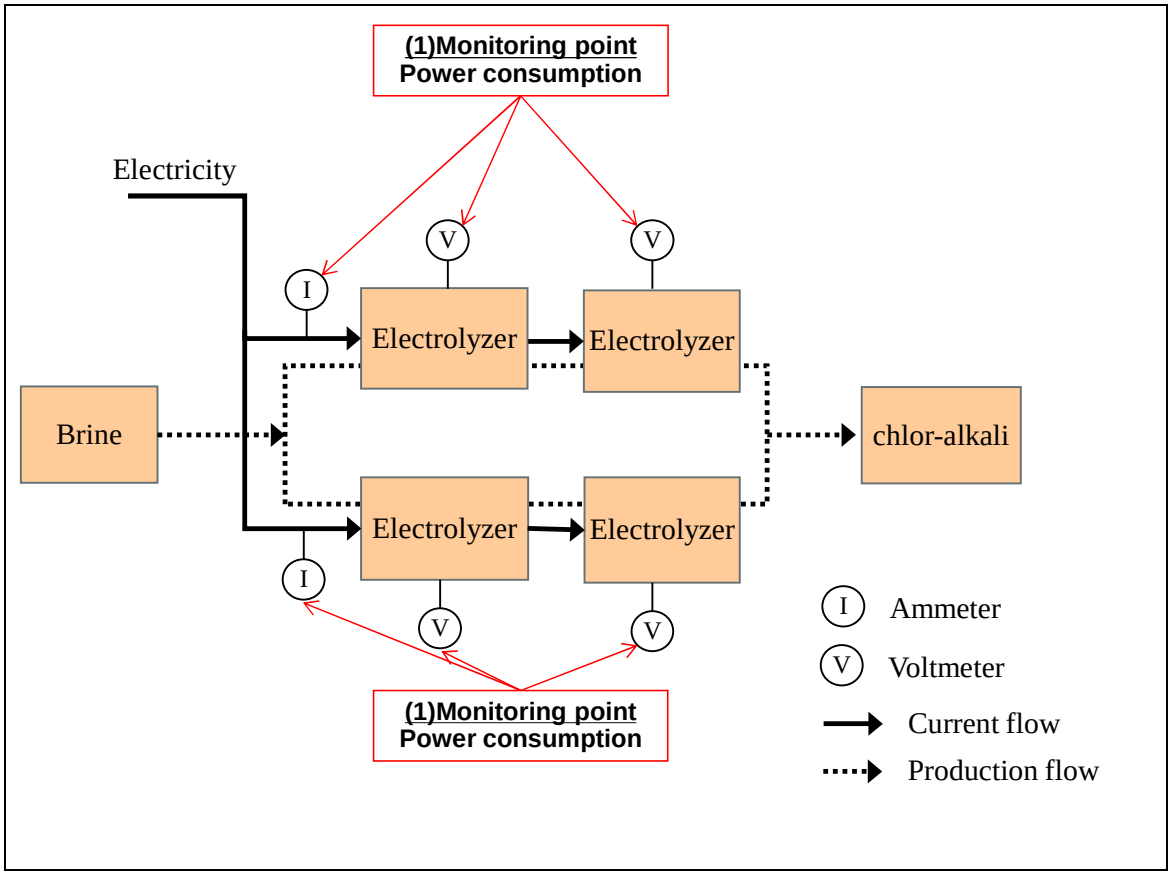
	Project specific electricity consumption is derived from specifications based on initial performance test by manufacturer.	

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Electricity consumption by reference electrolyzer	CO_2
Project emissions	
Emission sources	GHG type
Electricity consumption by project electrolyzer	CO_2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project



C.3. Estimated emissions reductions in each year

Year	Estimated Reference	Estimated Project	Estimated Emission

	emissions (tCO_2e)	Emissions (tCO_2e)	Reductions (tCO_2e)
2013	-	-	-
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	65,486.9	62,143.4	3,073
2018	70,096.0	66,806.1	3,289
2019	70,096.0	66,806.1	3,289
2020	70,096.0	66,806.1	3,289
2021	70,096.0	66,806.1	3,289
2022	4,609.1	4,392.7	216
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	-	-	-
2028	-	-	-
2029	-	-	-
2030	-	-	-
Total (tCO_2e)			16,445

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	NO

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

・Date of the local stakeholder meeting.

31/10/2017

・Place of the meeting.

Meeting room of JANA.

・Attendance.

Employees of JANA and government officials of Saudi Arabia were invited as important

stakeholders as the project site is in the factory area and there are no residents. As the result of invitation, employees of JANA attended. ・Comments from attendance A brief introduction of the project was made and stakeholder comments were solicited. The attendees showed no negative comments to this project and had several questions about this project as described in the following section. There are no remaining questions to be replied.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
Employee of JANA	How to account CO2 emission reduction and issue the carbon credit?	CO2 emission reduction is calculated by comparing the difference of electricity consumptions between the project electrolyzer and reference type electrolyzer. Electricity consumption of project electrolyze is monitored. The monitoring and calculation of CO2 emissions have to be in accordance with the approved JCM methodology. Based on the monitoring result, monitoring report is made and verified by a TPE. After completion of verification, project participants can request for issuance of credits to JC where the matter is discussed and decided.
Employee of JANA	How is the carbon credit exchanged to money?	JCM carbon credit cannot be exchanged in the market.
Employee of JANA	Are there any other projects, e.g. a solar power project in this country which possible to be implemented under the JCM?	・Kanematsu implements energy saving projects for corrugate cartons process in Indonesia and for refrigeration system in industrial cold storage in Thailand. ・Solar power project s are one of possibilities to be implemented under the JCM.

F. References
N/A

Reference lists to support descriptions in the PDD, if any.

Annex

Revision history of PDD		
Version	Date	Contents revised
01.0	19/12/2017	First edition
02.0	5/3/2018	Second edition